

COMPONENTS

FAQ

Q How can I overclock my Intel processor?

A We can't go into too much detail here, but standard Intel processors have a clock speed made up of a bus speed multiplied by the multiplier. The E2140 (reviewed right) has a 1.6GHz clock speed – a 200MHz bus multiplied by its 8x multiplier. The multiplier is locked on most models, so you can adjust only the bus speed.

To do this you'll need a motherboard that lets you adjust the processor's bus speed. Adjusting this can affect the speed at which the memory runs, so your motherboard must also let you set the memory speed independently.

Finally, you may need to increase the processor's voltage, so you'll need a motherboard that supports this. While testing the E2140 we changed the bus speed to 375MHz (3GHz core speed) and upped the voltage to 1.525V. If your overclock doesn't work, you may need to reset the BIOS and try different settings.

David Ludlow
Deputy Editor



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INTEL

Pentium Dual Core E2140

★★★★★

£42 inc VAT



The arrival of a new Pentium processor may not sound very exciting, but don't be put off by the name. Intel's Pentium Dual Core E2140 uses the company's Core technology, rather than being a throw-back to the previous generation of processors.

The reason for the old name is that this processor has a slower frontside bus (FSB) and less level 2 cache than Core 2 Duo processors. The 800MHz FSB (quad-pumped from a clock speed of 200MHz), compared with the 1,066MHz or 1,333MHz FSB speeds of the Core 2 Duos, means that the E2140 has less bandwidth to talk to system components and memory.

The E2140 has just 1MB of L2 cache, while the full Core 2 processors have 4MB, so it can cache less information from main memory, slowing down the overall performance. Even so, the 1MB of cache is intelligently shared between the processor's two cores: if only one core is busy, it gets the full cache, and if both cores need access to the same bit of data, it needs to be loaded into the cache only once. The processor uses Intel's SmartCache technology, which predicts what data needs to be loaded from memory and requests it before it's needed. It's a clever technique for reducing system bottlenecks and making sure the processor is constantly supplied with data for processing.

The E2140 runs at a clock speed of 1.6GHz (a multiplier of eight on the 200MHz FSB). At this speed it's a decent performer and did well in our video-encoding test with a score of 176. Performance in our more memory-intensive image-editing test was respectable, but far below that of Core 2 Duo processors, with a score of 125.

What makes this processor so astounding, though, is how far it can



be overclocked. You'll need a decent motherboard if you want to push it as far as it will go – we used Asus's Blitz Formula (see Labs on page 86) – as some of the motherboards we tried while testing this processor wouldn't pass the power on self-test (POST) after we overclocked it. We first overclocked the processor's FSB to 266MHz (1,066MHz quad-pumped), which is the same as the original Core 2 Duos. At this speed the Pentium Dual Core E2140 turned in an overall score of 165 in our 2D benchmarks, making it faster than the Core 2 Duo E6320, which costs twice as much.

Even better, we overclocked the FSB to 375MHz (1,500MHz quad-pumped), giving the processor a clock speed of 3GHz. It ran perfectly well with a stock

Intel cooler, reaching 57°C under full load, and achieved a score of 229 in our 2D benchmarks. This is faster than a Core 2 Duo E6750 (see 'Also Consider...', below), and incredible for a processor that costs less than £50.

Intel's Pentium Dual Core E2140 is a stunning processor. It provides excellent value as a basic entry-level processor for anyone on a tight budget, but it's also an incredible overclocker. If you want outrageous performance for very little money and you're prepared to up its speed, then this is the processor to buy.

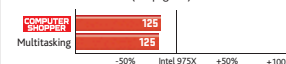
David Ludlow

SUMMARY

- ✓ Excellent value
- ✓ Incredible overclocker
- ✓ Excellent performance

PROCESSOR Two cores running at 1.6GHz, LGA775, 200MHz external bus (800MHz quad-pumped), 1MB L2 cache
PART CODE BX80557E2140
SUPPLIER www.scan.co.uk
DETAILS www.intel.com

PERFORMANCE (see page 62)



Also consider...

INTEL

Core 2 Duo E6700

★★★★★

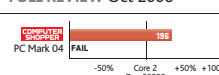
£194 inc VAT



Intel's new processor is based on the company's mobile technology. It is designed to be much more efficient than the P4. It's incredibly quick, achieving some of the highest benchmark results we've ever seen. You'll need a new Intel 965 or 975-based motherboard to use the E6700, but it's worth every penny, as it's by far the best-value processor you can buy.



PROCESSOR Two cores running at 2.66GHz, LGA775, 267MHz external bus, 4MB L2 cache
PART CODE BX80557E6700
SUPPLIER www.ebuyer.com
DETAILS www.intel.com
✓ Extremely fast; great value
FULL REVIEW Oct 2006



INTEL

Core 2 Duo E6750

★★★★★

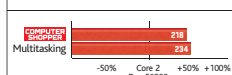
£117 inc VAT



Intel's latest Core 2 Duo processor has a faster frontside bus speed of 1,333MHz, so there's more bandwidth available to talk to system components, although you need a motherboard that supports this speed. It's incredibly quick, but also very cheap. If you're looking to build a new PC and want a lightning-fast processor, this is the one to buy.



PROCESSOR Two cores running at 2.66GHz, LGA775, 333MHz external bus (1,333MHz quad-pumped FSB), 4MB L2 cache
PART CODE BX80557E6750
SUPPLIER www.lambdtek.com
DETAILS www.intel.com
✓ Incredible value; amazing performance
✗ Needs a new motherboard
FULL REVIEW Oct 2007



SHUTTLE XPC SG33G5

★★★★

£240 inc VAT

If you want to build a media centre PC, an HDMI output is a valuable option as it lets you connect your computer to an LCD TV easily. With Shuttle's XPC SG33G5 you get an onboard HDMI output, so you don't even need to add your own graphics card. Sadly, the on-board graphics aren't good enough to decode Blu-ray or HD DVD movies.

The SG33G5 uses the same case as other XPCs, but that's no bad thing. It's compact, and the black brushed-metal finish looks stylish and neat. A flap covers the optical drive, so you won't need to find one with a bezel that matches the SG33G5's colour. A second flap hides the front-mounted audio, USB2 and FireWire ports when they're not in use, keeping the PC looking neat.

Unusually, the SG33G5 has no legacy ports at all, so you'll need to use a USB keyboard and mouse. While most modern mice are USB models, there are still a lot of PS/2 keyboards about and it's a shame that you'll have no choice but to upgrade if you've got a perfectly good one.

Taking the PC apart is very simple, as just three thumb screws hold the lid on. Once you're inside you have to remove the drive bay, which holds the hard disk and optical drive and has space for a third 3½in drive, such as a second hard disk, floppy drive or memory card reader. It lifts out of the way easily to give you access to the memory slots and LGA775 processor socket.

Shuttle uses its ICE cooling system, which runs heatpipes from the processor's heatsink to a single cooling fan on the rear of the case. There's just one fan inside this case, which keeps the noise down compared with some XPCs we've reviewed that contain four fans. Even so, the SG33G5 isn't silent and

creates a gentle hum when it's turned on. This wouldn't be very noticeable for a PC in an office or spare room, but if you plan to build a media centre, that sound could invade your living room.

The motherboard uses Intel's G33 chipset, so the barebones kit will accept all of Intel's new Core 2 Duo processors with a 1,333MHz frontside bus (FSB). It provides some basic overclocking options, including the ability to change the processor's FSB speed and increase its voltage; however, you can only change the voltage offset by +10 to +500mV, rather than setting the voltage at which you want to run the processor. We had a little trouble trying to get our Pentium Dual Core E2140 (see the review opposite) to overclock to its limit and overclocked it to run with an FSB speed of only 1,066MHz.

After installing Windows Vista we ran our usual benchmarks, with the SG33G5 connected to a monitor through its analogue output. Its 2D benchmark scores were about what we'd expect from our test Intel Core 2 Duo E6300, but our graphics tests ran into the same problems we've



discovered with other G33-based computers. Call of Duty 2 refused to run, displaying a DirectX 9.0c error. We updated the graphics driver with drivers from both Shuttle's and Intel's websites, but neither update fixed the problem. Running Prey returned an unplayable result at all resolutions, so the onboard graphics are definitely unsuitable for playing games. Windows Vista's Aero Glass 3D interface ran flawlessly, though, so they are fine if you don't want to play games.

Fortunately for those who do like games, there's a PCI-E x16 slot for a dedicated graphics card. Before you can use it, you have to change a row of jumpers to switch the SG33G5 from using HDMI to using the PCI-E x16 slot. There are 12 pairs of pins that need to have the jumpers changed, but Shuttle provides the jumpers as two blocks of six, so making the change is quick and easy. Strangely, the power supply doesn't have a PCI-E power connector, so you'll need a Molex-to-PCI-E adaptor to power any graphics card that requires it.

Shuttle's XPC SG33G5 is an attractive mini-barebones PC. It accepts all the latest processors and has space for a full-sized graphics card, while the HDMI output is useful for those with an LCD TV. However, it's quite expensive, not the best design for sitting quietly beneath your TV and the graphics are no good for HD.

David Ludlow

SUMMARY

- ✓ HDMI output
- ✗ Expensive
- ✗ Poor graphics drivers

BAREBONES PC LGA775 processor socket, 2x DDR2 DIMM slots, Intel G33 graphics, 1x PCI-E x16, 2x SATA ports, 10/100/1,000 network, 6x USB2, 2x FireWire, 7.1 audio, 1x 5¼in, 2x 3½in drive bays
PART CODE SG33G5
SUPPLIER www.theglowlounge.com
DETAILS www.shuttle.com

SAPPHIRE X1950 Pro

★★★★★

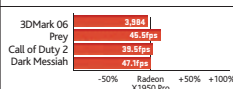
£94 inc VAT



The X1950 Pro is an excellent card. It

blasted through all our games tests at high detail and resolution settings. It doesn't support DirectX 10, but there probably won't be many games that require this over the next year. For those on a budget, this is the graphics card to buy.

GRAPHICS CARD ATI Radeon X1950 Pro chipset, PCI-E x16 interface, 570MHz core speed, 36 pixel pipelines, 256MB GDDR3 memory running at 700MHz (1.4MHz effective).
PART CODE 11095-01-20R
SUPPLIER www.kikatek.com
DETAILS www.sapphiretech.com
 ✓ Fast in DirectX 9 games; good value
 ✗ Doesn't support DirectX 10
FULL REVIEW Oct 2007



SHUTTLE XPC SD32G2

★★★★★

£188 inc VAT

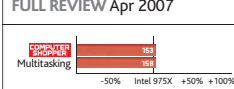
PRICE CUT!



The SD32G2 looks smart, but you'll need an optical drive with a silver bezel to

avoid spoiling its looks. It's easy to build thanks to the detailed instructions. Performance was excellent in our 2D tests, near the top of the recent Labs test. With support for Core 2 Duo processors, it's an excellent barebones kit.

BAREBONES PC LGA775 processor socket, 2x DDR2 533/667 DIMM slots, Intel 945G graphics, 1x PCI-E x16, 2x SATA ports, 10/100/1,000 network, 6x USB2, 2x FireWire, 7.1 audio, 1x 5¼in bays, 2x 3½in bays
PART CODE SD32G2
SUPPLIER www.ebuyer.com
DETAILS www.shuttle.com
 ✓ Plenty of room inside case; easy to assemble
FULL REVIEW Apr 2007



EVGA 8800GTS ACS3

★★★★★

£200 inc VAT

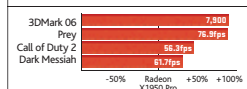


EVGA has overclocked its 8800GTS from Nvidia's reference design, making for a very fast

graphics card. Its test results were close to those from a high-end 8800GTX, even though it's around £150 cheaper. With DirectX 10 support, this card can handle both old and modern games easily.



GRAPHICS CARD Nvidia GeForce 8800GTS chipset, 590MHz core speed, 320MB DDR3 memory running at 920MHz (1.84GHz effective), 96 stream processors running at 1.45GHz, PCI-E x16 interface
PART CODE 320-P2-E817-AR
 ✓ Very fast; excellent value
FULL REVIEW Oct 2007





PNY GeForce 8400 GS

★★

£46 inc VAT

PNY's GeForce 8400 GS uses one of Nvidia's entry-level DirectX 10 graphics chips. This uses stream processors, which do different jobs depending on the graphical environment it's trying to generate. For indoor scenes, most of the stream processors can be set as shaders to provide detail, while in outdoor scenes they can draw vertices to create a lot of objects.

Nvidia's high-end 8800GTS chip has 96 stream processors, but the 8400 GS has just 16. These run at 900MHz, while the core runs at just 450MHz. This isn't the only limitation, either: the card has just 256MB of DDR2 RAM, while high-end cards use DDR3. What's more, Nvidia has used a 64-bit memory interface, which drastically reduces the memory's bandwidth and slows graphics processing.

The test results were slow. None of our games was playable at our default resolution of 1,280x1,024 with 4x AA and 8x anisotropic filtering. With no anti-aliasing and a resolution of 1,024x768, the card managed a frame rate of 27.2fps in Prey. Call of Duty 2 still ran at a very poor 16.8fps, so this card isn't much good for anything but the least demanding games.

In its favour, it is tiny and occupies only the length of a PCI-E x16 slot, so it fits almost any case. Its single fan isn't particularly loud, and it has an HDCP-compliant DVI output and a VGA output, so you could use it in a media centre.

However, Sapphire's HD 2400 XT Silent (*Shopper* October 2007) has similar games performance, an HDMI output and is passively cooled, so it's silent. It's the same price, too, and would be our choice for a media centre. If you want to play games, Sapphire's X1950 Pro (see Also Consider...) costs £50 more, but will cope with any modern game.

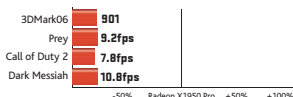
David Ludlow

SUMMARY

- ✓ Small
- ✗ Poor games performance
- ✗ No HDMI output

GRAPHICS CARD Nvidia GeForce 8400GS chipset, 256MB GDDR2 memory, PCI-E x16 interface, 450MHz core speed, 16 stream processors running at 900MHz, two DVI, VGA output, TV-out
PART CODE GH8400SN1E24Y-SB
SUPPLIER www.lambda-tek.com
DETAILS www.pny.com

PERFORMANCE (see page 62)



LEGO Mindstorms NXT

★★★★★

£170 inc VAT



There's a clear link between an obsessive interest in computers and a love of Lego, as demonstrated by Google founder Larry Page's early experiments building an inkjet printer from the plastic bricks. If you want your kids to grow up to be Web 4.0 billionaires, or if you've never quite grown out of the Lego habit yourself, the Mindstorms NXT robotic system could be ideal.

The NXT system consists of software, one controller unit, three motors, pressure, sound, light and ultrasonic motion sensors and a generous helping of Lego bricks and parts to connect them. You create programs on your computer and download them to the controller, which you can then disconnect, allowing your robots to roam freely.

Lego's programming software has been designed to be simple, and uses a schematic approach similar to a flow chart. You drag commands in order, instructing the controller to turn a motor or take a reading from a sensor, for instance. The system is ideal for kids but will seem a little limiting if you've ever used a normal text-based programming language. The software also includes a series of tasks that guide the user through building different robots for different purposes. You're free to ignore these, of course, and we quickly assembled a three wheeled buggy contraption that raced around the lab grabbing anything it found in its claws.

The Mindstorms system isn't without its limitations. With only three motors you're limited in effect to building mobile robots with one other function or stationary robots with three, and although it should be possible to program the controller via Bluetooth, we couldn't get it to connect to our PC. Fortunately, programming your robot through a USB cable is simple and fast. Nonetheless this is a powerful system, and although the price is rather high you do get enough parts to build some impressive robots. It's an interesting and exciting educational toy, and surprisingly good fun for adults too.

Tom Royal

SUMMARY

- ✓ Simple to program
- ✓ Lots of parts included
- ✗ Expensive

ROBOT CONSTRUCTION KIT Requires Windows XP SP2, 800MHz processor, 256MB RAM, 300MB disk space, USB port
SUPPLIER www.play.com
DETAILS www.lego.com

CHOOSING A... Processor

Follow the steps to find your ideal specs

MANUFACTURER: AMD

PROCESSOR: Sempron 3000+

SOCKET: AM2

Recommended minimum in grey

1 A processor with the minimum specifications above costs around £35. It's not particularly quick, though, and is best suited to standard office applications. As it uses the latest Socket AM2 interface, you'll need a new motherboard to match, but you'll be able to upgrade to any of AMD's newer processors later.

2 If you're upgrading only your processor, you'll be limited by your motherboard's socket type. AMD Socket 754 boards provide the least choice, as an Athlon 64 3400+ is the fastest compatible processor. Socket 939 motherboards provide more options, including dual-core X2 processors and going as fast as the FX-60. Socket AM2 is the latest, and supports AMD's full range.

Intel's LGA775 socket has been around for a few years, but check your motherboard's manual for processor support as only the latest chipsets support Intel's Core 2 Duo processors.

3 If you're building a PC from scratch, it's best to pick the processor first and choose a motherboard to match. If you're building a basic office PC, a single-core Intel Celeron or AMD Sempron is fine. If you do a lot of intensive tasks, a dual-core AMD X2 or Intel Core 2 Duo processor is a better choice.

The Core 2 Duo range is our current favourite. The E6320 (around £100) is a good entry-level choice, while the E6700 (around £195) is very quick. If your motherboard doesn't support Core 2 Duo, the Pentium D range of dual-core processors is still quick. The old single-core Pentium 4s and Athlon 64s are no longer good value and we'd avoid them unless your motherboard doesn't support dual-core processors.

4 Want to overclock? Intel's Extreme processors and AMD's FX processors are multiplier-unlocked, so you can adjust their speeds without affecting your memory or other components. However, the Core 2 Extreme X6800 costs around £600.

5 You can buy Intel's mobile Core 2 Duo and Core Duo processors, too. However, you'll need a motherboard or barebones PC that's compatible with Socket 479. Mobile processors are more expensive, so buy one only if you need to.